CLAIMS

1. An air conditioning system (1) (101) (201) (401) (601) configured to treat the latent heat load and the sensible heat load in a room by performing a vapor compression refrigeration cycle operation, comprising:

a plurality of first utilization side refrigerant circuits (10a, 10b) (110a, 10b) (210a, 210b) (310a, 2310b) (410a, 2410b) (510a, 2510b) (610a, 2610b) (710a, 210b) (910a, 910b) having an adsorbent heat exchanger (22, 23, 32, 33) (122, 123, 132, 133) (322, 323, 332, 333) (522, 523, 532, 533) (722, 723, 732, 733) (922, 923, 932, 933) provided with an adsorbent on the surface each thereof, capable of alternating between an adsorption process in which moisture in air is adsorbed onto the adsorbent by causing the adsorbent heat exchanger to function as an evaporator that evaporates refrigerant and a regeneration process in which moisture is desorbed from the adsorbent by causing the adsorbent heat exchanger to function as a condenser that condenses the refrigerant, and connected in parallel with one another;

a plurality of second utilization side refrigerant circuits (10c, 10d) (110c, 110d) (210c, 210d) (310c, 310d) (410c, 410d) (510c, 510d) (610c, 610d) (710c, 710d) (1010a, 1010b) having an air heat exchanger (42, 52) (142, 152) (242, 252) (342, 352) (442, 452) (542, 552) (642, 652) (742, 752) (1022, 1032), capable of exchanging heat between refrigerant and air, and connected in parallel with one another,

wherein

the air conditioning system can supply a room with air that passed through the adsorbent heat exchanger, and can supply a room with air that passed through the air heat exchangers.

2. The air conditioning system (1) (101) (201) (301) (401) (501) (601) (701) according to claim 1, comprising:

a heat source side refrigerant circuit (10e) (110e) (210e) (310e) (410e) (510e) (610e) (710e) including a compression mechanism (61) (161) (261) (361) (461) (561) (661) (761) and a heat source side heat exchanger (63) (163) (263) (363) (463) (563) (663) (763) and used as a heat source by both the first utilization side refrigerant circuits (10a, 10b) (110a, 110b) (210a, 210b) (310a, 310b) (410a, 410b) (510a, 510b) (610a, 610b) (710a, 710b) and the said second utilization side refrigerant circuits (10c, 10d) (110c, 110d) (210c, 210d) (310c, 310d) (410c, 410d)

(510c, 510d) (610c, 610d) (710c, 710d),

wherein

the first utilization side refrigerant circuits are connected to a discharge gas connection pipe (8) (108) (208) (308) (408) (508) (608) (708) connected to a discharge side of the compression mechanism, and are connected to an inlet gas connection pipe (9) (109) (209) (309) (409) (509) (609) (709) connected to an inlet side of the compression mechanism.

3. An air conditioning system (1) (101) (201) (301) (401) (501) (601) (701) configured to treat the latent heat load and the sensible heat load in a room by performing a vapor compression refrigeration cycle operation, the air conditioning system comprising:

a first utilization side refrigerant circuit (10a, 10b) (110a, 110b) (210a, 210b) (310a, 310b) (410a, 410b) (510a, 510b) (610a, 610b) (710a, 710b) having an adsorbent heat exchanger (22, 23, 32, 33) (122, 123, 132, 133) (322, 323, 332, 333) (522, 523, 532, 533) (722, 723, 732, 733) provided with an adsorbent on the surface each thereof and capable of alternating between an adsorption process in which moisture in air is adsorbed onto the adsorbent by causing the adsorbent heat exchanger to function as an evaporator that evaporates refrigerant, and a regeneration process in which moisture is desorbed from the adsorbent by causing the adsorbent heat exchanger to function as a condenser that condenses refrigerant;

a plurality of second utilization side refrigerant circuits (10c, 10d) (110c, 110d) (210c, 210d) (310c, 310d) (410c, 410d) (510c, 510d) (610c, 610d) (710c, 710d) having an air heat exchanger (42, 52) (142, 152) (242, 252) (342, 352) (442, 452) (542, 552) (642, 652) (742, 752), capable of exchanging heat between refrigerant and air, and connected in parallel with one another; and

a heat source side refrigerant circuit (10e) (110e) (210e) (310e) (410e) (510e) (610e) (710e) having a compression mechanism (61) (161) (261) (361) (461) (561) (661) (761) and a heat source side heat exchanger (63) (163) (263) (363) (463) (563) (663) (763), and used as a heat source by both the first utilization side refrigerant circuit and the second utilization side refrigerant circuits,

wherein

the first utilization side refrigerant circuit is connected to a discharge gas connection pipe (8) (108) (208) (308) (408) (508) (608) (708) connected to a discharge side of the compression mechanism, and is connected to an inlet gas connection pipe (9) (109) (209) (309) (409) (509) (609) (709) connected to an inlet side of the

compression mechanism;

the air conditioning system can supply a room with air that passed through the adsorbent heat exchanger, and

the air conditioning system can supply a room with air that passed through the air heat exchanger.

4. The air conditioning system (1) (101) (401) (501) according to claim 2 or claim 3, wherein

the second utilization side refrigerant circuits (10c, 10d) (110c, 110d) (410c, 410d) (510c, 510d) are connected to a liquid connection pipe (7) (107) (407) (507) that is connected to a liquid side of the heat source side heat exchanger (63) (163) (463) (563), and also switchably connected to the discharge gas connection pipe (8) (108) (408) (508) and the inlet gas connection pipe (9) (109) (409) (509) through a switching mechanism (71, 81) (171, 181) (471, 481) (571, 581).

5. The air conditioning system (201) (301) (601) (701) according to claim 2 or 3, wherein

the second utilization side refrigerant circuits (210c, 210d) (310c, 310d) (610c, 610d) (710c, 710d) are connected to a liquid connection pipe (207) (307) (607) (707) connected to a liquid side of the heat source side heat exchanger (263) (363) (663) (763), and are connected to the inlet gas connection pipe (209) (309) (609) (709).

6. The air conditioning system (101) (301) (501) (701) according to any one of claims 2 to 5, wherein

the first utilization side refrigerant circuit (110a, 110b) (310a, 310b) (510a, 510b) (710a, 710b) and the second utilization side refrigerant circuit (110c, 110d) (310c, 310d) (510c, 510d) (710c, 710d) constitute an integrated utilization unit (102, 103) (302, 303) (502, 503) (702, 703).

7. The air conditioning system (101) (301) (501) (701) according to claim 6, wherein

the utilization unit (102, 103) (302, 303) (502, 503) (702, 703) can supply a room with air that was dehumidified or humidified in the adsorbent heat exchanger (122, 123, 132, 133) (322, 323, 332, 333) (522, 523, 532, 533) (722, 723, 732, 733).

8. The air conditioning system (101) (301) (501) (701) according to claim 6, wherein

the utilization unit (102, 103) (302, 303) (502, 503) (702, 703) can exchange heat through the air heat exchanger (142, 152) (342, 352) (542, 552) (742, 752) between refrigerant and air that was dehumidified of humidified in the adsorbent heat exchanger (122, 123, 132, 133) (322, 323, 332, 333) (522, 523, 532, 533) (722, 723,

732, 733).

9. The air conditioning system (1) (101) (201) (301) according to any one of claim 2 to claim 8, wherein

the air conditioning system is configured to calculate a required latent heat treatment capacity value (Δh) and a required sensible heat treatment capacity value (ΔT) in order to control the operational capacity of the compression mechanism (61) (161) (261) (361) based on the required latent heat treatment capacity value and the required sensible heat treatment capacity value.

10. The air conditioning system (1) (101) (201) (301) according to claim 9, wherein

the air conditioning system is configured to calculate a target evaporation temperature (TeS) and a target condensation temperature (TcS) of the system as a whole based on the required latent heat treatment capacity value (Δh) and the required sensible heat treatment capacity value (ΔT) in order to control the operational capacity of the compression mechanism (61) (161) (261) (361) based on the target evaporation temperature and the target condensation temperature.

11. The air conditioning system (1) (101) (201) (301) according to claim 10, wherein

the air conditioning system is configured to calculate an evaporation temperature difference (ΔTe) between the target evaporation temperature (TeS) and the evaporation temperature (Te) and to calculate a condensation temperature difference (ΔTc) between the target condensation temperature (TcS) and the condensation temperature (Tc) in order to control the operational capacity of the compression mechanism (61) (161) (261) (361) based on the evaporation temperature difference and the condensation temperature difference.

12. The air conditioning system (1) (101) (201) (301) according to any one of claims 9 to 11, wherein

a switching time interval between the adsorption process and the regeneration process in the adsorbent heat exchanger (22, 23, 32, 33) (122, 123, 132, 133) (322, 323, 332, 333) can be changed.

13. The air conditioning system (1) (101) (201) (301) according to any one of claims 1 to 12, wherein

at system startup, a room is supplied with air that passed through the air heat exchanger (42, 52) (142, 152) (242, 252) (342, 352), and outdoor air is prevented from passing through the adsorbent heat exchanger (22, 23, 32, 33) (122, 123, 132, 133) (322, 323, 332, 333).

14. The air conditioning system (1) (101) (201) (301) according to any one of claims 1 to 12, wherein

at system startup, in a state in which switching between the adsorption process and the regeneration process in the plurality of adsorbent heat exchangers (22, 23, 32, 33) (122, 123, 132, 133) (322, 323, 332, 333) is stopped, outdoor air is passed through one of the plurality of adsorbent heat exchangers and then is exhausted to the outside, and also room air is passed through an adsorbent heat exchanger among the plurality of adsorbent heat exchangers, besides the one through which the outdoor air passed, and then is supplied to a room again.

15. The air conditioning system (1) (101) (201) (301) according to any one of claims 1 to 12, wherein

at system startup, a switching time interval between the adsorption process and the regeneration process in the adsorbent heat exchanger (22, 23, 32, 33) (122, 123, 132, 133) (322, 323, 332, 333) is made longer than that during normal operation.

16. The air conditioning system (1) (101) (201) (301) according to any one of claims 13 to 15, wherein

the system startup operation is terminated after a predetermined period of time elapsed since system startup.

17. The air conditioning system (1) (101) (201) (301) according to any one of claims 13 to 15, wherein

the system startup operation is terminated after a temperature difference between the target temperature of room air and the temperature of room air is equal to or below a predetermined temperature difference.

18. The air conditioning system (1) (101) (201) (301) according to any one of claims 13 to 17, wherein

before the system startup operation starts, whether or not a temperature difference between the target temperature of room air and the temperature of room air is equal to or below a predetermined temperature difference is determined, and

when the temperature difference between the target temperature of room air and the temperature of room air is equal to or below a predetermined temperature, the system startup operation is prevented from being performed.

19. The air conditioning system (401) (501) (601) (701) according to any one of claims 2 to 8, comprising pressure control mechanism (473, 483) (573, 583) (673, 683) (773, 783) connected to a gas side of the air heat exchanger (442, 452) (542, 552) (642, 652) (742,

752) and configured to control the evaporation pressure of refrigerant in the air heat exchanger when the air heat exchanger is caused to function as an evaporator that evaporates refrigerant.

20. The air conditioning system (401) (501) (601) (701) according to claim 19, wherein

the evaporation pressure of refrigerant, when the air heat exchangers (442, 452) (542, 552) (642, 652) (742, 752) are caused to function as an evaporator that evaporates refrigerant, is controlled by the pressure control mechanism (473, 483) (573, 583) (673, 683) (773, 783), based on the dew point temperature of room air.

21. The air conditioning system (401) (501) (601) (701) according to claim 20, comprising a pressure detection mechanism (474, 484) (574, 584) (674, 684) (774, 784) configured to detect the refrigerant pressure in the air heat exchanger (442, 452) (542, 552) (642, 652) (742, 752), wherein

the air conditioning system calculates a target evaporation pressure value (P3) based on the dew point temperature of room air and uses the pressure control mechanism (473, 483) (573, 583) (673, 683) (773, 783) to control the evaporation pressure of refrigerant, which was detected by the pressure detection mechanism , to be equal to or higher than the target evaporation pressure.

22. The air conditioning system (401) (501) (601) (701) according to claim 21, comprising condensation detection mechanisms (446, 456) (546, 556) (646, 656) (746, 756) configured to detect the presence of condensation in the air heat exchangers (442, 452) (542, 552) (642, 652) (742, 752), wherein

when condensation is detected by the condensation detection mechanism, the target evaporation pressure value (P3) is changed.

23. The air conditioning system (401) (501) (601) (701) according to claim 21, comprising a condensation detection mechanism (446, 456) (546, 556) (646, 656) (746, 756) configured to detect the presence of condensation in the air heat exchanger (442, 452) (542, 552) (642, 652) (742, 752), wherein

when condensation is detected by the condensation detection mechanisms, the compression mechanism (461) (561) (661) (761) is stopped.

24. The air conditioning system (401) (501) (601) (701) according to claim 21, comprising condensation detection mechanism (446, 456) (546, 556) (646, 656) (746, 756) configured to detect the presence of condensation in the air heat exchanger (442, 452) (542, 552) (642, 652) (742, 752), wherein,

the second utilization side refrigerant circuit (410c, 410d) (510c, 510d) (610c, 610d)

(710c, 710d) comprises utilization side expansion valve (441, 451) (541, 551) (641, 651) (741, 751) connected to a liquid side of the air heat exchangers, and

when condensation is detected by the condensation detection mechanism, the utilization side expansion valve is closed.

25. The air conditioning system (401) (501) (601) (701) according to any one of claims 2 to 8 and 19 to 24, wherein

a switching time interval between the adsorption process and the regeneration process in the adsorbent heat exchanger (22, 23, 32, 33) (522, 523, 532, 533) (722, 723, 732, 733) can be changed.

26. The air conditioning system (401) (501) (601) (701) according to any one of claims 19 to 25, wherein

at system startup, treatment of the latent heat load in a room by the first utilization side refrigerant circuit (410a, 410b) (510a, 510b) (610a, 610b) (710a, 710b) is given priority over treatment of the sensible heat load in a room by the second utilization side refrigerant circuit (410c, 410d) (510c, 510d) (610c, 610d) (710c, 710d).

27. The air conditioning system (401) (501) (601) (701) according to claim 26, wherein

at system startup, treatment of the sensible heat load in a room by the second utilization side refrigerant circuit (410c, 410d) (510c, 510d) (610c, 610d) (710c, 710d) is stopped until the dew point temperature of room air is equal to or below the target dew point temperature.

28. The air conditioning system (401) (501) (601) (701) according to claim 26, wherein

at system startup, treatment of the sensible heat load in a room by the second utilization side refrigerant circuit (410c, 410d) (510c, 510d) (610c, 610d) (710c, 710d) is stopped until the absolute humidity of room air is equal to or below the target absolute humidity.

29. The air conditioning system (401) (501) (601) (701) according to any one of claims 26 to 28, wherein

at system startup, outdoor air is passed through an adsorbent heat exchanger, which is performing the regeneration process, among the plurality of adsorbent heat exchangers (22, 23, 32, 33) (522, 523, 532, 533) (722, 723, 732, 733), and then is exhausted to the outside, and also, room air is passed through an adsorbent heat exchanger, whichever is performing the adsorption process, among the plurality of adsorbent heat exchangers, and then is again supplied to a room.

30. The air conditioning system (401) (501) (601) (701) according to any one of claims 26

to 29, wherein

before starting the system startup operation, whether or not a dew point temperature difference between the target dew point temperature of room air and the dew point temperature of the room air is equal to or below a predetermined dew point temperature difference is determined, and

when a dew point temperature difference between the target dew point temperature of room air and the dew point temperature of room air is equal to or below a predetermined dew point temperature difference, the startup operation is prevented from being performed.

31. The air conditioning system (401) (501) (601) (701) according to any one of claims 26 to 29, wherein

before starting the system startup operation, whether or not an absolute humidity difference between the target absolute humidity of room air and the absolute humidity of the room air is equal to or below a predetermined absolute humidity difference, and

when an absolute humidity difference between the target absolute humidity of room air and the absolute humidity of room air is equal to or below a predetermined absolute humidity difference, the system startup operation is prevented from being performed.